

REMARKS/ARGUMENTS

Claims 1-7 remain in this application. Claims 8-31 are canceled. Claims 32-40 are new.

I. Background Discussion

In understanding the differences between Applicant's film, as claimed, to the cited prior art (Gruen et al. 5,989,511 and 5,772,760), it is worthwhile to briefly review the processes from which these films are made. That is, the subject application utilizes a different process than that described in the cited Gruen et al. patents and, accordingly, the resulting films have different properties.

Both the Applicant and Gruen et al. use plasma enhanced chemical vapor deposition processes to grow diamond films. The Gruen process improved previous process for growing "diamond films". Some contributions of Gruen et al. is that the process may be done at a relatively low substrate temperature (i.e. above 470°C as compared to conventional processes of 800°C to 1000°C) and with a smaller percent of hydrogen being introduced into the system. The lower temperature allows for diamond films to be applied to substrates having lower melting temperatures than was possible under conventional diamond file processes. The reduction of hydrogen corresponds to a reduction of defects in the film. As pointed out by Gruen, it is conventionally understood that the introduction of hydrogen is a double edge sword in that it is necessary for the growth of diamond film, but it is also the cause of defects. (See background discussion for either patent).

Gruen et al. further explains that there are conventional methods wherein smooth films can be grown at low substrate temperatures, such as room temperature, and in the absence of hydrogen. However, such processes do not form a true diamond structure, rather forming "amorphous" diamond or "diamond-like" films. (Patent 5,772,760: Col.

2, lines 8-17). These diamond-like films have an increase in graphitic character and have properties which do not lend themselves to useful commercial applications. *Id.* Do to the low quality of diamond-like films, Gruen teaches away from these types of processes.

The present application forms a novel diamond film having many properties similar, or superior, to those grown by diamond film processes such as Gruen, but does so utilizing steps previously only usable in forming diamond-like films. In particular, the process of the subject application may be performed at ambient temperatures and without any introduction of hydrogen. As hydrogen is not introduced, the resulting film is substantially free of graphite inclusions. And, since the film can be prepared at ambient temperatures, greater control over film thickness and surface roughness can be exhibited.

II. Claims Discussion

The Examiner rejected claim 1 under 35 USC 103(a) stating that although Gruen et al (5,989,511 or 5,772,760) does not explicitly disclose the exclusion of graphite, Gruen et al. says that the diamond films are essentially sp³ bonding which infers that no graphite is present.

Applicant agrees that the Gruen et al. patents do not state whether the described film is substantially free of graphite inclusions. But, Applicant respectfully disagrees that the Gruen et al. patents support the Examiner's inference.

Argumento. replete in both cited patents (e.g. in Example VIII in both patents), Gruen acknowledges that the films contain sp² carbon, albeit very little sp² carbon. Gruen also observed that films grown at the lower hydrogen concentrations (films C and E) are essentially pure diamond without trapped hydrogen as compare to films B, D and F which were grown at higher hydrogen concentrations. Accordingly, the inference is that a reduction in hydrogen yields films having less sp² carbon.

The present invention does not introduce hydrogen into the process. [0038]. And further, a turbomolecular pump is used to remove hydrogen gases that are created during the deposition process. [0038]. Since the Gruen et al. patents require the introduction of hydrogen (see Table I of both patents), whereas the present invention does not, any inference made should be that Gruen et al. is not substantially free of sp² carbon.

Since the Examiner's inference is improperly drawn, the burden of establishing a proper rejection with regards to claim 1 has not been met. Accordingly, Applicant believes that this claim is in condition for allowance.

Applicant also adds claims 32 and 33 which further the distinction between the cited prior art and the invented film by restricting the limitation of substantially free of graphite to be less than 3 weight percent and 1 weight percent of graphite, respectively. [Supported at paragraph 0024]. As the cited prior art, singular and in combination, is silent as to the weight percent of graphite in their films, and a proper inference cannot be made that the claimed ranges have been met, it is believed that claims 32 and 33 are also in condition for allowance.

The Examiner rejected claim 5 under 35 USC 103(a) as being unpatentable over either of the Gruen et al. patents.

Applicant objects to the rejection as being improper since the Examiner failed to provide any justification, comment or rationale for the rejection.

Additionally, the cited references do not disclose the claimed thickness range of the film. The claimed thickness of 40 nm to 1000 nm is substantially thinner than the films of Gruen et al. Reviewing Table I of either Gruen et al. patent, the Gruen et al. films have a thickness ranging from 2000 nm to 10,000 nm.

The subject film can be made ultra thin because the film is grown at a low temperature, e.g. ambient temperature, thereby allowing for slow, controlled and consistent growth of crystallite, yielding a consistent and controllable thickness.

In contrast, the Gruen et al. films are prepared at temperatures above 460°C. These high temperatures cause a faster, less controllable rate of crystallite growth. That is, the crystallites are relatively large, causing the film to achieve a thickness beyond the claimed range. It is noted that even if, somehow, it were possible to terminate the process at precisely the targeted thickness during at the high process temperature, upon cooling to room temperature the film would either crack or elastically stretch due to thermal mismatch with the substrate. Since no cited prior art teaches or suggest the limitations of claim 5, singularly or in combination, Applicant believes that this claim is allowable.

The Examiner rejected claim 7 under 35 USC 103(a) as being unpatentable over either of the Gruen et al. patents.

Applicant objects to the rejection as being improper since the Examiner failed to provide any justification, comment or rationale for the rejection.

Additionally, the cited references do not disclose the claimed range of surface roughness range for the film. The claimed surface roughness of being an average root mean square of less than 5.00 nm is substantially smoother than that taught or suggest by either of the Gruen et al. patents. In reviewing Table I of either Gruen et al. patent, it is shown that the Gruen et al. films have a surface roughness 30 to 376 nm.

The subject film can be made ultra smooth since the film is grown at a low temperature, e.g. ambient temperature, thereby allowing for slow, controlled and consistent growth of crystallites.

In contrast, the Gruen et al. films are prepared at temperatures above 460°C. These high temperatures cause a faster, less controllable rate of crystallite growth, such that relatively large crystallites are formed.

The difference in surface roughness between the claimed film and the Gruen et al. films is analogous to a road covered with large rocks compared to small gravel. With large rocks, the ride would be very bumpy. On the other hand, a road covered with small gravel would provide a much smoother ride. Since the cited prior art does not teach or suggest the limitations of claim 7, Applicant believes that this claim is allowable.

New claims 34 and 35 further limit the maximum limit of surface roughness to less than 2.00 nm and 1.50 nm respectively and, thus, should be allowable for the reasons as presented in respect to claim 7. [Supported provided 0054].

Applicant brings to the Examiner's attention Gruen et al.'s discussion regarding ultra-smooth films (i.e. 3-6 nm). (Patent 5,989,511: Col. 3, lines 2-4; Col. 14, line 56 – Col. 15, line 13). Here, Gruen et al. is measuring the surface roughness of a graphite layer that is disposed on the diamond film, not the surface roughness of the diamond film itself. Accordingly, this section has no application to claim 7.

Claims 36-38 add the limitations of having a film that is pre-stressed, with compressive or tensile stress. [Support provided at 0040] There is no teaching or suggestion whatsoever by the cited prior art of a film having compressive or tensile stress.

The remaining claims, whether previously presented or new, depend from at least one of the aforementioned discussed claims and, accordingly, should also be allowable.


Applicant hereby petitions under 37 CFR 1.136(a) for a one-month extension of time to respond to the Office action mailed September 9, 2005.

Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Respectfully submitted,

EVERMAN LAW FIRM, PA

By

A handwritten signature in black ink, appearing to read 'Gregory R. Everman', is written over a horizontal line.

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